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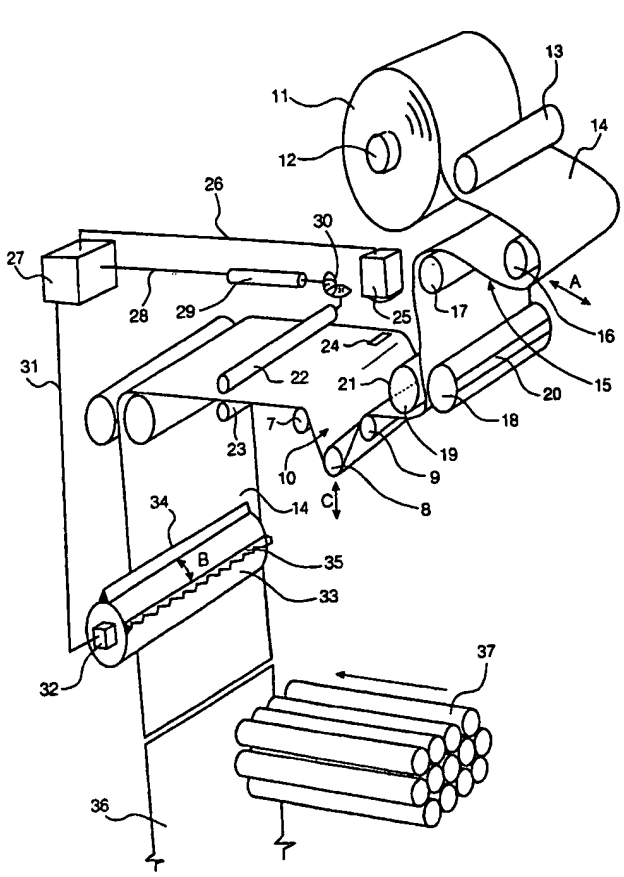

(57) Abstract: A packet with a foil inner element is enhanced by the provision of printed images (111) on the removable upper part (112) of a foil inner liner (100). This removable part of the foil liner can be used as a voucher or to bear advertising messages or the like. Apparatus for ensuring that the image (111) is registered in an accurate position on the foil comprises driving rollers (22, 23; 45, 46) driven by an electric motor (29; 48) which is controlled by signals from a processor (27; 58) which receives input signals from a photocell (25; 57) for detecting registration marks (24) on the foil (14) as it passes a predetermined position on its path to a cutter (33; 51). The phase of the foil drive mechanism, taken, for example, from the cutter roller (33; 51), is detected and compared with the signal from the photocell (25) in order to determine whether the control drive rollers (22, 23; 45, 46) are to be advanced or retarded to maintain the print in register with the cut layer.

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IMPROVED PACKAGING AND PROCESS AND APPARATUS FOR ITS MANUFACTURE

This invention relates to improved packaging, a process for its manufacture and apparatus for carrying out the process.

Packets or cartons having a so-called " flip top" are frequently used in the tobacco industry for the packaging of cigarettes and cigars.

In such packets or cartons the cigarettes are wrapped in a thin layer of foil, a part of which can be torn off to expose the ends of the cigarettes and to allow access thereto. To assist in removal of the foil, it is manufactured with a so-called " pull front" portion, that is a part attached to the rest of the foil by a line of weakness, typically a line of perforations.

An improvement on such conventional packets or cartons has now been made.

It is now proposed to provide the pull front with a printed image. Problems arise, however, with printed foil in obtaining precise registration of the image on

the pull front as the individual foil wrappers and cut from an elongate web of foil. This problem is compounded if the foil is embossed prior to being cut from the web.

The present invention seeks to provide apparatus for achieving this objective, and a process for producing printed foil wrappers with images accurately located on the pull front or other location.

According to one aspect of the present invention there is provided apparatus for adjusting the relative longitudinal position of a web passing through a machine having a plurality of pairs of rollers driven in synchronism with one another, comprising at least one pair of control rollers between which the web passes on its path through the machine, means for driving the control rollers independently of the said synchronised rollers, means for detecting a registration mark on the web and for comparing it with data concerning the phase of the synchronised rollers, and means for varying the speed of the control rollers when at least one pair of synchronised rollers reaches a predetermined phase range.

The apparatus of the present invention can be used in the production of a so-called " flip-top" carton having a

foil inner element provided with a pre-printed image which is exposed to view when the flip-top carton is opened. This opens up the possibility of promotional and marketing opportunities which were not previously available. For example the removable part of the foil inner element may be used as a voucher exchangeable for value. Or alternatively this removable second part of the foil inner element (the pull front)may be such as to be collectable in its own right.

Existing processes for manufacturing flip-top cartons having an inner foil generally involve passing a continuous length or strip of foil through a processing station or series of processing stations. One such processing station comprises a pair of nip rollers capable of driving the length of foil, with one or both rollers of the pair being provided with suitable embossing surfaces. The foil is thus embossed as it passes between the rollers. Subsequently it can be provided with a line of weakness, which may be made by cutting a continuous line partially through the thickness of the foil, although more usually this is achieved by a series of discrete incisions extending completely through the thickness of the foil to form a line of perforations. The weakened, perforated, foil is then separated into

individual, discrete pieces of foil which are individually introduced into a wrapping station where they are wrapped around the product prior to insertion into a carton.

It is necessary for the cutting to be synchronised with the perforation, to ensure that the line of weakness ends up in the correct position on each cut piece of foil so that it can in turn end up in the correct position in the assembled flip-top carton. This may be achieved by appropriately spacing perforator and separator blades on the same cutter roller. The exact position of the length of foil with respect to the perforating and/or cutting station is irrelevant in conventional processes and in existing machinery is neither detectable nor adjustable.

The present invention relates to an improved process for the continuous production of discrete lengths of foil for forming foil inner elements for flip-top cartons, which improved process allows a portion of each foil inner element to have a pre-printed design visible when the inside of the carton is exposed.

According to a second aspect of the present invention there is provided a process for the continuous production

of discrete lengths of foil for forming foil inner elements for flip-top cartons, which foil inner elements in use enwrap a product contained in a carton and are provided with a part which is visible when the flip-top of the carton is opened, a section of which part is removable to expose and allow access to the product, which removable section of the foil inner element carries a printed image, the process comprising the steps of: conveying a continuous sheet of previously printed foil from a source to an embossing station; embossing the foil at the first processing station, conveying the embossed foil to a second processing station separating the continuous sheet of foil at the second processing station into discrete lengths by means of a cutting member; synchronising the actions of the first and second processing stations, wherein the continuous sheet of foil is provided with a plurality of printed images and the process additionally includes the steps of: detecting the position of the print image on the foil being conveyed and comparing this position with the phase of the first and second synchronised stations; adjusting,if required, the longitudinal position of the foil with respect to the phase of the said first and second station; and adjusting the longitudinal position of the foil, if required, with respect to the said synchronised station.

The present invention also comprehends the improved packet itself.

Thus, according to a third aspect of the present invention there is provided a flip-top carton comprising: an outer case which forms a container for a product, which outer case is provided with a flip top portion which is attached to the rest of the outer case along a fold line, which flip top portion is movable about the fold line from a first position in which the container is closed to a second position in which the inside of the container is exposed; and a foil inner element capable of enwrapping a product contained in the container formed by the outer case, which foil inner element has a first part which fits inside the container formed by the outer case and a second part which is visible when the inside of the container is exposed by opening the flip top, in which at least a section of the second part is removable from the first part so as to expose a product enwrapped by the foil inner, and wherein at least a part of the visible second part carries a printed image.

The process of the present invention may include the

additional step of and the apparatus may additionally include means for enwrapping a product in the foil inner element. For this purpose the apparatus may be provided with an enwrapping station. The product may be enwrapped in the foil inner before or after the foil inner element has been inserted into a flip-top carton although the former is preferred.

The separating station may take the form of a pair of nip rollers. One of the rollers acts as a support or anvil roller. The other of the rollers is pressed in use towards the support roller and is provided with suitable perforating or cutting members or blades. A single such cutting member may be provided (which then requires a full revolution between actions) or a series of members may be provided which sequentially come into contact with the foil to carry out the required function (so that only a partial revolution of the roller is required between actions).

The perforating and cutting may be performed at successive stations or may be combined so that formation of the line of weakness or perforation and separation takes place in the same processing station on the same order. In such an embodiment the perforation and the

cutting are inherently synchronised so that no relative adjustment is required.

The means of determining the position of print on the continuous sheet of foil may take the form of a print registration system or station which includes means for detecting images such as print registration marks located at discrete positions on the foil. Any suitable detection means, such as a photodetector, may be used. Because the main transport members or rollers of the foil handling apparatus are synchronised with one another it is preferred to adjust the position of the foil with respect to these rather than to adjust the angular position of the cutter with respect to the foil.

The process may additionally include the step of and the apparatus may additionally be provided with means for manufacture and/or assembly of the outer case of the flip-top carton. The outer case is preferably of card and may be formed from a single blank. It may be provided with an inner frame formed from a separate blank, which inner frame is inserted into the outer case in which position it supports the top portion and loosely retains it by friction in the closed position in a known way.

A central control unit may be provided to control all of the components and to ensure synchronisation thereof.

The apparatus may form a part of a larger packaging machine or it may take the form of an adaptation kit for modifying existing packaging machinery. The apparatus is especially suitable for use in machinery for packaging a product or commodity such as cigarettes. The apparatus may itself include means for packing a product. The inner foil element or the assembled carton containing the foil may be orientated with respect to the product supply or packing machine which fills the foil, which is then wrapped around the product, the carton closed and overwrapping of the product provided if required.

Embodiments of the present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of an embodiment of the apparatus of the present invention;

Figure 2 is a schematic view of one other embodiment of the apparatus of the present invention; and

Figure 3 is a perspective view of a carton formed as an embodiment of the present invention.

Referring now to the drawings and particularly to Figure 1 thereof, the apparatus shown comprises a feed roll 11 of foil 14 which is driven to rotate by an electric motor 12. A roller 13 guides the foil 14 from the feed roll 11 into a loop 15 defined by a resiliently mounted roller 16 and a turn roller 17. The loop 15 can be of variable size depending on whether the motor 12 drives the feed roller 11 faster or slower than the take up of the foil 14 in the later parts of the apparatus to be described below, and this is accommodated by transverse movements of the roller 16 in the directions of the double arrow A in Figure 1.

From the turn roller 17 the foil 14 passes between two embossing rollers 18, 19 each of which have textured cylindrical surfaces for applying to the foil embossed texture which, at the same time, provides an attractive aesthetically pleasing finish and also a degree of resilience which improves the handling properties of the foil for wrapping the products and protecting them within the carton as will be described below. Each of the embossing rollers 18, 19 has a narrow flat 20, 21 formed on the cylindrical surface, and the two flats 20, 21 are so oriented that they face one another once upon each

revolution of the rollers 18, 19. Rotation of the rollers 18, 19 is synchronised by a mechanism (not shown) which is related to the rotation of the motor 12 driving the feed roll 11 although the motor 12 is not tied unequivocally to the speed of the rollers 18, 19 and can vary above and below this speed in a manner which will be described in more detail below.

From the embossing rollers 18, 19 the foil, now embossed, passes a path-length adjusting loop 10 defined by three rollers 7, 8 and 9 one of which, the roller 8, is adjustable in position for reasons which will be explained below. From the loop 10 the foil then passes between two drive control rollers 22, 23 driven via a bevel gear mechanism 30 by an electric motor 29 the control of which is entirely independent of the remainder of the drive rollers. Having passed between the two drive control rollers 22, 23 the foil 14 is turned through two guide rollers 38, 39 and passes a cutter roller 33 which has a counter roller or anvil roll (not shown). The cutter roller 33 has a serrating blade 35 comprising a plurality of teeth, and a cutter blade 34 angularly spaced by an arc B of the circumference of the roller 33. The cutter roller 33 and its anvil roller (not shown), the guide roller 38, 39, the embossing

rollers 18, 19 the guide roller 17 and the take off roller 13 are all driven in synchronism by a drive mechanism (not shown) which may be mechanical or electrical. The feed roll 11 is primarily driven in synchronism with the other rollers, but the motor 12 may be caused to accelerate or decelerate by a signal from a sensor (not shown) which detects the instantaneous position of the guide roller 16 along the length of the double arrow A, increasing in speed as the loop 15 reduces in size and the roller 16 shifts to the left of the position shown in Figure 1, therefore allowing the loop 15 to increase in size, or reducing in speed if the roller 16 moves towards the right of the position shown in Figure 1 causing the loop 15 to reduce in size.

Such adjustment movements are required in order to take account of variations in the instantaneous longitudinal position of the foil 14 in relation to the phase of the embossment rollers 18, 19 and the other rollers mentioned above which are driven in synchronism therewith. The foil 14 is printed along its length with a plurality of images which are intended to appear at a particular point in the wrapping of the product. For this purpose the position of the image must bear a predetermined relationship with the cut line formed by the blade 34 as

the foil 14 passes the cutter roller 33, being located between the line of perforations formed by the perforator blade 35 and the separation formed by the cutter blade 34. In order to ensure that accurate registration is achieved, the foil 14 is formed with a plurality of registration marks 24 at the same time as the printing takes place, the registration marks 24 being accurately positioned in relation to the images on the foil itself. The passage of a registration mark 24 is detected by a photodetector 25 which feeds a signal on line 26 to a processor 27. The processor 27 also receives a phase angle signal taken from the cutter roller 33 by a sensor 32. The signal from the sensor 32 is fed to the processor 27 on line 31.

The processor 27 acts to compare the phase angle of the cutter roller 33 with the signal from the photo cell 25 to establish whether the registration mark 24 is arriving in registration with the required phase angle or whether it is ahead of or behind this required phase. The processor 27 is also able to determine the magnitude of any displacement between the arrival of the registration mark and the appropriate phase angle to determine, in absolute terms, the magnitude of the correction movement on the foil 14 required to bring that section of the foil

14 into the correct longitudinal position such that, when it passes the roller 33, it will be cut with the image printed thereon in the correct location.

For this purpose the motor 29, which receives its control signal from the processor 27, is caused to accelerate or decelerate for a predetermined time to increase or decrease the speed of the foil 14 for a short period of time when the two flats 20, 21 of the embossing rollers 18, 19 are in register with one another, at which time the foil 14 is not gripped between these two rollers for a short period of time. The phase angle of the rollers 18, 19 is known to the processor 27 from the sensor 32, which detects the phase angle of the roller 33, since the roller 33 and the rollers 18, 19 are held in a predetermined phase relationship by the mechanism (not shown) of the machine drive.

Thus, when the two flats 20, 21 on the embossing rollers 18, 19 are facing one another, the drive rollers 22, 23 cause the web 14 to shift in relation to the embossing rollers 18, 19 in such a way that, depending on whether the registration mark 24 has arrived early or late, will either retard the foil 14, thus allowing the loop 15 to increase slightly in size, or will advance the foil 14

thereby drawing a little extra foil from the loop 15 and causing it to reduce.

Some embossment rollers are provided with a surface texture which forms an embossed image on the foil. In order to ensure that this embossed image is always in the correct position in relation to the cut line of separation of the panel 36, and since the phase relationship between the embossment rollers 18,19 and the cutter roller 33 is fixed and unvarying, the path length from the embossment rollers 18, 19 to the cutter roller 33 is adjusted by varying the size of the loop 10. This is achieved by adjusting the position of the roll 8 in the direction of the double arrow c, either up or down as needed. In this embodiment the adjustment is made manually as part of the setting up operation, and then left in the adjusted position. In other embodiments, not shown, the position of the roll 8 may be varied by a servo motor controlled by a sensor signal from a photodetector or other type located at the cutting station. Routine control of the path length can thus be effected during operation of the machine.

After the foil has been separated into individual elements by the cutter roller 33, it passes to a wrapping

station where it is contacted by a stack 37 of the products, in this example cigarettes, and caused to enwrap these as it is conveyed to the further processing parts of the machinery which are otherwise known and do not form part of the present description. The adjustment system described is suitable for use, for example in a Focke 3500 or Mollins HLP cigarette packaging machine and may be provided as a retro fit kit of parts to adapt or modify existing machines of this type as well as being incorporated in new machines. In other machines the stack of cigarettes may be presented to the foil in a different orientation from that shown, for example turned through 90° from the orientation shown.

An alternative foil cutting apparatus is illustrated in Figure 2. In this embodiment a feed roll 40 of foil is mounted freely rotatable on a spindle (not shown) the rotation of which is braked by an electromagnetic brake schematically illustrated 41 in Figure 2. From the reel 40 the foil 14 passes straight to a pair of embossing rollers 42, 43 which, like the rollers 18, 19 in the embodiment of Figure 1, have respective flats 44,45 to allow adjustments in the position of the foil 14 in relation to the embossing rollers 42, 43 to be made. In other embodiments (not shown)the embossing roller is

dispensed with and the foil used in its flat state bearing only the images printed thereon.

In this embodiment, from the embossing rollers 42 the foil 14 passes between two drive control rollers 45,46 driven via a bevel gear 47 from an electric motor 48 and then passes between two guide rollers 49,50 which lead it between a cutter roller 51 and anvil 52. From the cutter roller 51 the cut sections of foil 14 are transferred by a suction roller 53 into contact with a transfer arm 54 which also has a suction head 55, which oscillates between the position shown in solid outline in Figure 2 and the position shown in broken outline where the cut piece 14'of foil is laid onto a conveyor for transport to the further station where it is wrapped around the product (not shown) prior to insertion into a carton.

In this embodiment adjustments to the longitudinal position of the foil 14 again take place by detecting the arrival of registration marks 56 by a photodetector 57 which supplies signals to a processor which is also fed with a signal representing the phase angle of the machine drive, and therefore the cutter roller 51. If the registration mark arrives " late" in relation to the phase of the drive member the motor 47 is accelerated and

at the same time the electromagnetic brake 47 is released slightly, while if the mark 56 arrives " early" the motor 48 is slowed and the brake 41 tightened. This, of course, takes place only when the relief portion or flats 44, 45 of the embossing rollers are facing one another. This embodiment is suitable, for example, for the DG X2000 machine and may be formed as a modification or retro fit kit for existing such machines.

Figure 3 illustrates the form of a carton or flip top packet of cigarettes of the type to which the present invention relates.

The carton 61 is generally rhomboid in shape and has an outer case 62 having opposing pairs of sides which with the bottom of the outer case 62 defines an inner container suitable for, cigarettes. Attached to the outer case 62 by a hinge or fold line is a flip-top 63. When the top 63 is flipped forward the container defined by the outer case 62 is closed but, as shown in Figure 3, when the top 63 is flipped back the inside of the container is open. Within the outer case 62 an inner frame 64 is inserted. The inner frame 64 acts as an extension of the sides of the outer case 62 and supports the top 63 when it is in the closed position by two

lateral tabs 60 in a known way. The inner frame 64 is formed from a front panel 65, the lower portion of which extends part way down into the container and is adhered to the front side 66 of the outer case 62. The front panel of the inner frame 64 has a cut-out portion 67 which provides a view of and access to the contents of the container. The inner frame 64 has two parallel extending side portions 68 only one of which is visible in Figure 3. The side portions 68 are separated from the front panel 65 by a perforated fold line 69. A notch provided in each of the fold lines 69 leads to the formation of the above-mentioned pair of laterally extending tabs 60 on either side of the front panel 65 of the inner frame 64. The tabs 60 engage the inside of the lid 63 when it is in the closed position thereby retaining it in place by friction.

Within the outer case 62 and the inner frame 64 a foil layer or liner, referred to as a foil inner element 100 is inserted. The foil inner element 100 is used to wrap the cigarettes contained in the container formed by the outer case 62. The top edges of the foil inner element 100 are folded around the cigarettes to enclose them. The so-called pull front 111 of the foil inner element 100 is visible when the flip-top 63 is in the open

position. An image or images 112 printed on the pull front 111 of the foil inner element 100 is then visible. The pull front 111 of the foil inner element 100 can, therefore, be used for marketing messages, promotional vouchers or the like. The foil inner element 100 is provided with a line of perforations (not shown) by which the pull front 111 of the foil inner element 100 is separable from its lower part. The pull front 111 may thus be used to form a pre-printed voucher or the like.

The present invention is advantageous as it provides a print registration system capable of varying synchronisation of a pre-printed foil in relation to a perforator and/or cutter having a fixed synchronisation with the foil drive rollers. With the present invention it is possible to provide a foil inner element for a flip-top carton having a pre-printed image which is exposed to view when the flip-top carton is opened and which may be carried on the part of the foil inner element which is pulled out (and usually thrown away) when the product in the carton is used. This opens up the possibility of promotional and marketing opportunities which were not previously possible. Errors in registration can be detected and the print position automatically adjusted within pre-set limits. Apparatus

according to the present invention can be provided as an add-on, up-grade module or unit for use in existing packaging machinery.

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CLAIMS

1. Apparatus for adjusting the relative longitudinal position of a web passing through a machine having a plurality of pairs of rollers driven in synchronism with one another, comprising at least one pair of control rollers between which the web passes on its path through the machine, means for driving the control rollers independently of the said synchronised rollers, means for detecting a registration mark on the web and for comparing it with data concerning the phase of the synchronised rollers, and means for varying the speed of the control rollers when at least one pair of synchronised rollers reaches a predetermined phase range.

2. Apparatus as claimed in Claim 1, in which the said at least one pair of synchronised rollers comprise embossing rollers, and the said predetermined phase range is one over which the embossing rollers release the web from engagement therewith.

3. Apparatus as claimed in Claim 2, in which the embossing rollers are provided with flats which are in register with one another facing the web passing between

the rollers.

4. Apparatus as claimed in any of claims 1 to 3, in which the control rollers are located downstream of the said embossing rollers with reference to the direction of advance of the web.

5. Apparatus as claimed in any preceding claim, in which the means for detecting a registration mark is a photodetector located between the embossing rollers and the control rollers.

6. Apparatus as claimed in any preceding claim, in which the said means for driving the control rollers independently of the synchronised rollers comprises an electric stepper motor.

7. Apparatus as claimed in Claim 6, in which the said stepper motor is controlled by the output of a processor receiving signals from the said photodetector and from means sensitive to the phase of the synchronised rollers whereby to cause the control rollers to accelerate or decelerate the web as it passes between them.

8. Apparatus as claimed in any preceding claim, in

which there are provided perforation blades on the cutter roller for perforating the web as it passes between it and an anvil roller.

9. Apparatus as claimed in any preceding claim, in which the rotation of the feed roller is controlled by an electromagnetic brake.

10. Apparatus as claimed in any preceding claim, in which there are provided loop rollers for forming an open loop of web between the feed roller and the embossing rollers, at least one of the loop rollers being displaceable to enlarge or reduce the size of the loop whereby to take up or provide slack in the web to correlate with adjustments made by the control rollers.

11. A flip-top carton comprising: an outer case which forms a container for a product, which outer case is provided with a flip top portion which is attached to the rest of the outer case along a fold line, which flip top portion is movable about the fold line from a first position in which the container is closed to a second position in which the inside of the container is exposed; and a foil inner element capable of enwrapping

a product contained in the container formed by the outer case, which foil inner element has a first part which fits inside the container formed by the outer case and a second part which is visible when the inside of the container is exposed by opening the flip top, in which at least a section of the second part is removable from the first part so as to expose a product enwrapped by the foil inner element, and wherein at least a part of the visible second part carries a printed image.

12. A process for the continuous production of discrete lengths of foil for forming foil inner elements for flip-top cartons, which foil inner elements in use enwrap a product contained in a carton and are provided with a part which is visible when the flip-top of the carton is opened, a section of which part is removable to expose and allow access to the product, which removable section of the foil inner element carries a printed image, the process comprising the steps of: conveying a continuous sheet of previously printed foil from a source to an embossing station; embossing the foil at the embossing station, conveying the embossed foil to a cutter station separating the continuous sheet of foil at the cutter station into discrete lengths by means of a cutting

member; synchronising the actions of the embossing and cutter stations, wherein the continuous sheet of foil is provided with a plurality of printed images and the process additionally includes the steps of: detecting the position of the print image on the foil being conveyed and comparing this position with the phase of the at least one of the synchronised embossing and cutter stations; adjusting, if required, the longitudinal position of the foil with respect to the phase of the said embossing and cutter stations; whilst simultaneously releasing the foil from engagement with the embossing station.

13. Apparatus for the continuous production of discrete lengths of foil for forming foil inner elements for flip-top cartons, which foil inner elements, in use, enwrap a product contained in the carton and are each provided with a part which is visible when the flip-top of the carton is opened, a section of which part is removable to expose and allow access to the product, and which removable section of the foil inner carries a printed image, which apparatus comprises: means for delivering a continuous sheet of foil; a first processing station having an embossing member for embossing the foil; a second processing station having a cutting member capable

of dividing the continuous sheet into discrete lengths;

means for synchronising the movement of the first and second processing stations; means of detecting the position of a print image on the continuous sheet of foil being conveyed through the apparatus with respect to the phase of the first and second synchronised stations; and means for adjusting the longitudinal position of the foil with respect to the said second station.

14. A process or apparatus according to Claim 12 or Claim 13, which additionally includes the step of or means for inserting a foil inner element into a flip-top carton, with the foil orientated with respect to the carton so that the part of the thus-formed foil inner element which carries the printed image is visible when the flip-top of the carton is opened to expose a product enwrapped by the foil inner element.

15. A process or apparatus according to any one of Claims 12, 13 or 14, which includes the step of or means for enwrapping a product in the foil inner element, before the foil inner element has been introduced into a flip-top carton.

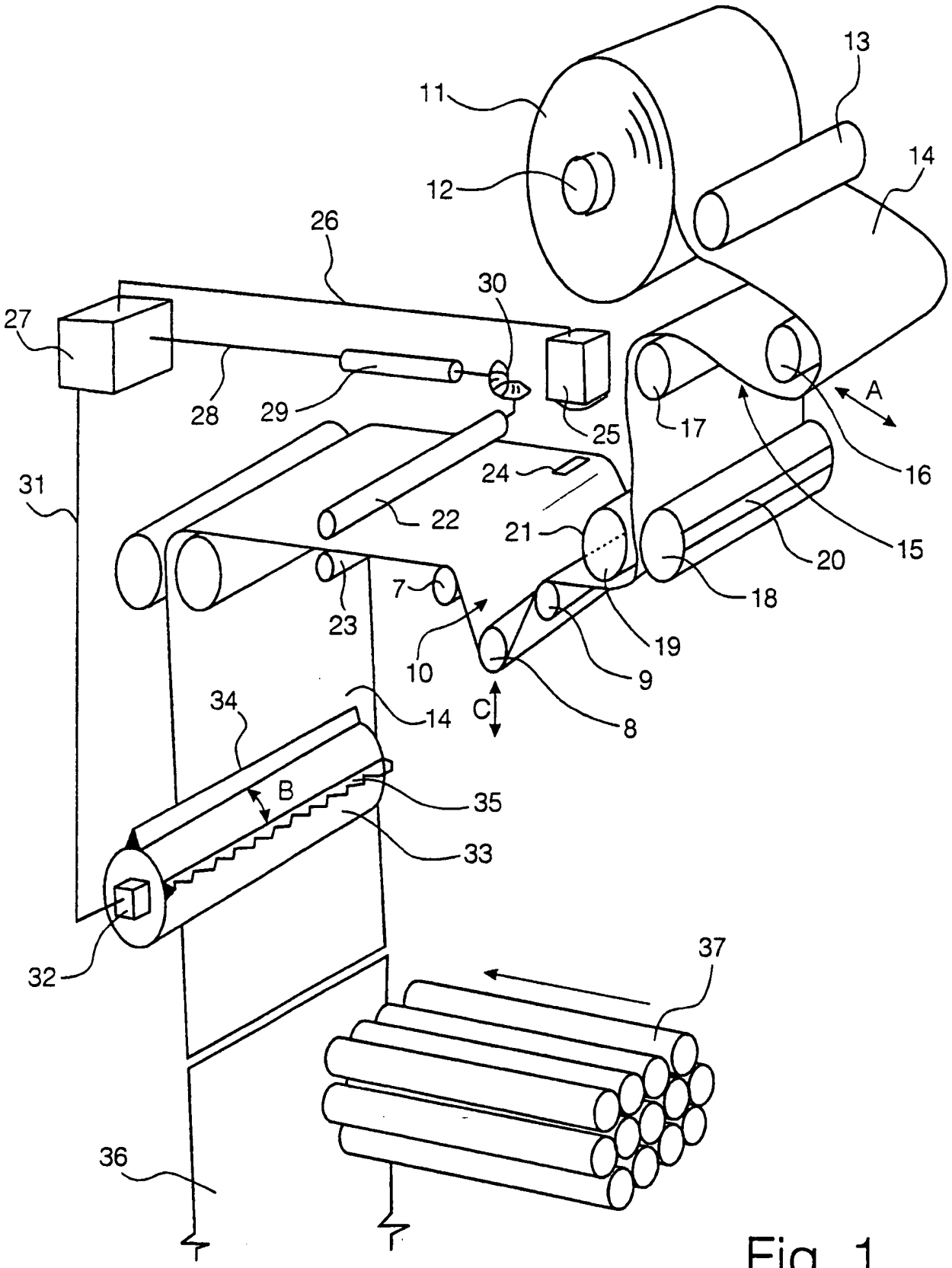
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Fig. 1

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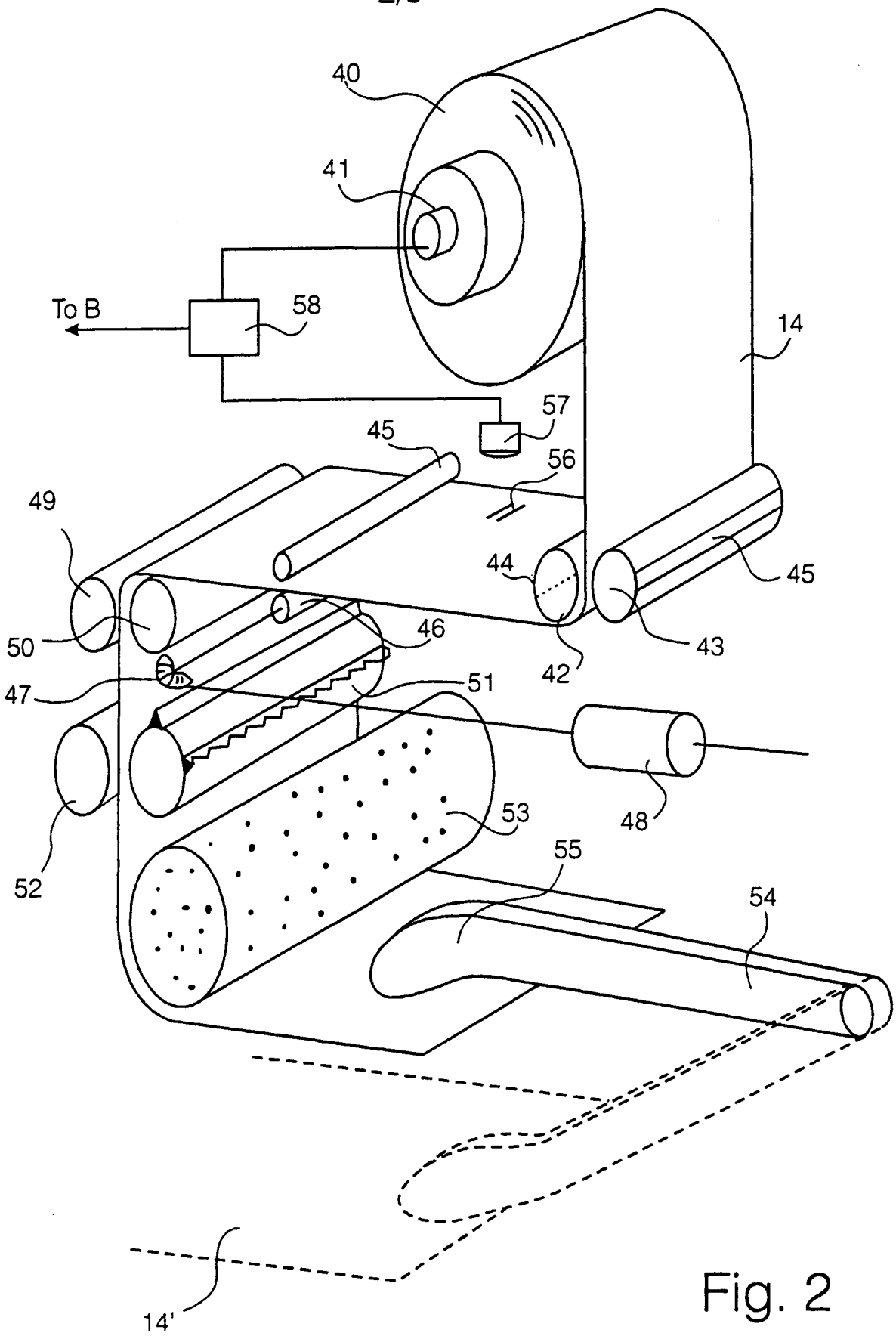

Fig. 2

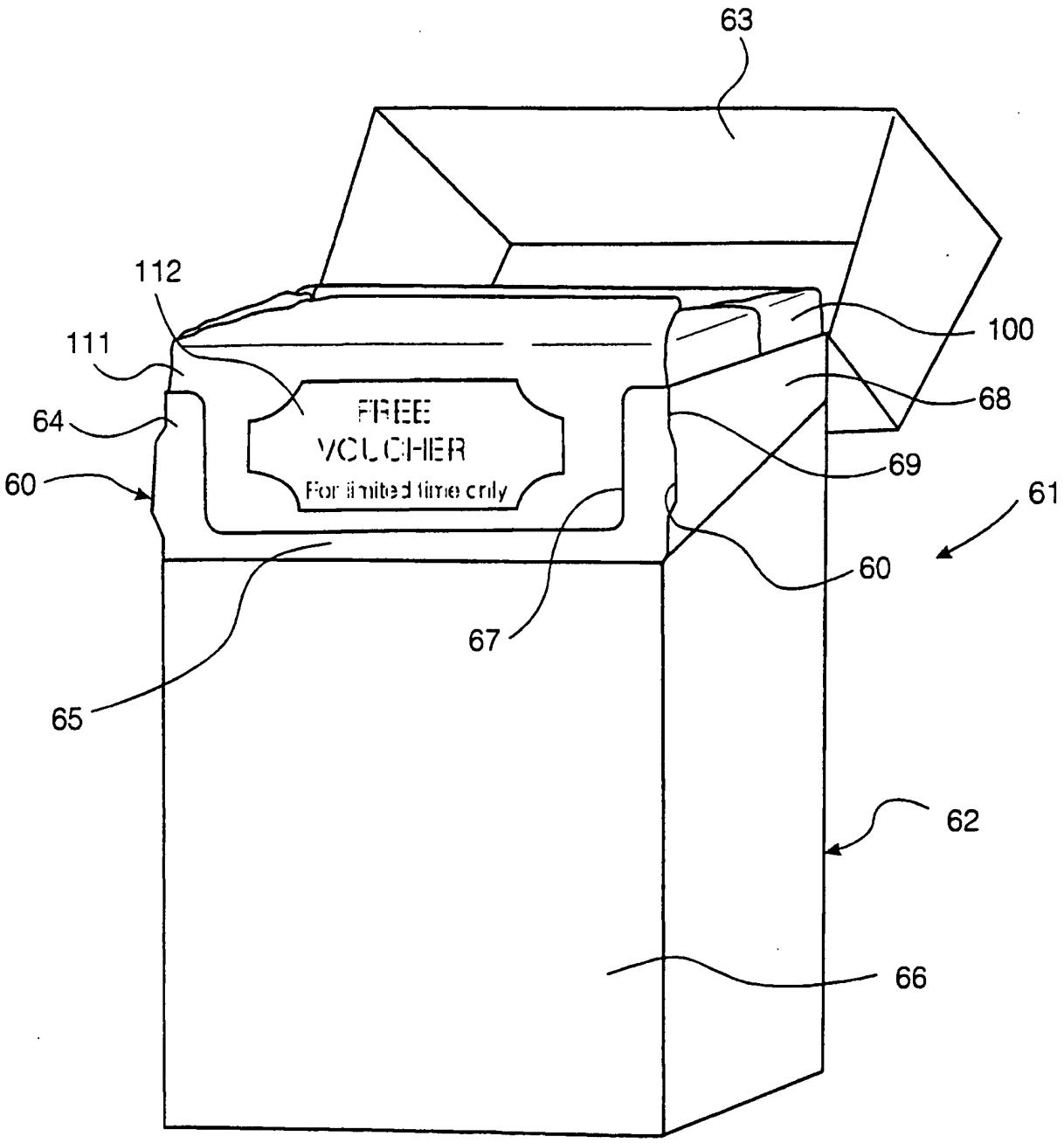
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Fig. 3